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Review

# Internal double-J stent was associated with a lower incidence of ureteroileal anastomosis stricture than external ureteral catheter for patients undergoing radical cystectomy and orthotopic neobladder: A systematic review and meta-analysis

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ABSTRACT

*Objective:* Proper techniques used in procedures might play an important role in reducing ureteroileal anastomosis stricture (UIAS) for patients undergoing orthotopic neobladder. The present study was to evaluate the efficacy of internal double-J stent versus external ureteral catheter on UIAS for patients undergoing radical cystectomy and orthotopic neobladder.

*Methods:* A comprehensive search of the literature referring to the topic was performed on 10th January 2019 in PubMed, EMBASE and Google Scholar, by using key words as radical cystectomy, orthotopic neobladder, stricture, stenosis. The Cochrane Collaboration's RevMan 5.3 software was employed for data analysis. The incidence of UIAS was evaluated as primary outcome.

*Results:* Five studies were included eventually. The incidence of UIAS was lower in the group of internal double-J stent than that in the group of external ureteral catheter (odds ratio [OR], 0.49; 95% CI, 0.25–0.97; $p = 0.04$) with a low heterogeneity ($I^2 = 0\%$). Besides, internal double-J stent group had a trend of a shorter length of stay than external ureteral catheter group.

*Conclusions:* Based on the present meta-analysis, internal double-J stent placement was associated with a lower incidence of UIAS than external ureteral catheter for patients undergoing orthotopic neobladder. In addition, a trend of a shorter hospital stay was also detected, thus, internal double-J stent placement may be favored in the view of the enhanced recovery after surgery (ERAS).

## 1. Introduction

The orthotopic neobladder provides a common means of urinary diversion following radical cystectomy for patients with bladder cancer. In addition to the fact that the orthotopic neobladder provides a better quality of life than an ileal conduit [1], the advantage of protection of upper tract function has resulted in this approach being favored in clinical practice, not only by urologists but also by certain patients who strive for a normal appearance and social well-being. According to a cross-sectional study in China that included 2304 patients undergoing radical cystectomy, the orthotopic neobladder was the predominant choice for diversion (44%), followed by the ileal conduit (31%) [2]. However, postoperative ureteroileal anastomosis stricture (UIAS) remains a serious problem. Traditionally, a ureteral catheter, usually with a size of 6 Fr, has been used to sustain the ureteroileal tube by anchoring to the skin on the other end. In 2001, Salvatore et al. [3] first reported a new method; double-J stent implantation into the ureteroileal neobladder had an incidence of UIAS equal to that of an external catheter and resulted in a faster recovery after surgery. Several studies [4–6] in the last decade have also demonstrated a similar outcome as the study of Salvatore et al. [3]. In addition, Echo et al. [7] found a significantly lower incidence of UIAS in patients receiving internal double-J stent implantation than in those with an external ureteral catheter.

To our knowledge, there has not been a systematic review that has evaluated the efficacy of internal double-J stent implantation in UIAS. Thus, we aimed to summarize the studies published until now to hopefully provide a higher level of evidence on this issue.

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## 2. Methods

A comprehensive search of the available literature with PubMed, EMBASE and Google Scholar was performed to identify all studies published until January 2019. The key words included radical cystectomy, orthotopic neobladder, stricture, and stenosis. In addition, the references of these studies that were relevant to the topic were also identified. There was no language restriction. The present study has been registered on PROSPERO with the ID CRD42019121288. The work has been reported in line with PRISMA and AMSTAR guidelines.

### 2.1. Study selection and quality assessment

Studies designed only to compare postoperative outcomes between an internal double-J stent group and an external ureteral catheter group were included in the meta-analysis. Studies given full consideration for enrollment in the meta-analysis met the following criteria: (1) those that included patients undergoing radical cystectomy due to bladder cancer; (2) those where the orthotopic neobladder was the only method for urinary diversion used in the study; and (3) those where the number of events (UIAS) was reported. Reviews, single-arm studies or studies without sufficient data were excluded.

Two authors independently evaluated the potentially eligible studies. The quality of the studies was assessed according to the Newcastle-Ottawa Scale (NOS). One study with an NOS score ≥7 was recognized as having satisfactory quality and was then included.

### 2.2. Data extraction

The following data were independently extracted by two of the authors: study characteristics (author name, publication year, nationality, and sample size), intervention (internal double-J stent and external ureteral catheter), primary outcome (the number of patients developing UIAS), and secondary outcomes (length of stay, time to removal of the internal stent or external catheter, operation time and complications), if they were available.

### 2.3. Data synthesis and analysis

Review Manager 5.3 (The Cochrane Collaboration, Oxford, UK) was employed for meta-analysis, and a $p$ value $< 0.05$ was considered to indicate a significant difference for all of the statistical analyses. Heterogeneity among these studies was evaluated by the chi-square test and $I^2$ statistic.

The primary outcome was the incidence of UIAS after surgery. We also attempted to compare the operation time, length of stay, time to removal of the double-J stent or external ureteral catheter and complications between the two groups if possible.

## 3. Results

### 3.1. Study characteristics

Thirty-nine studies were identified from the electronic database. After the study assessment, five studies meeting the criteria were included in the present systematic review. The flow diagram shows the process of selection (Fig. 1). The characteristics of the five studies are presented in Table 1. Two were prospective studies, one of which was an RCT. The other three were case-control studies. All of the studies had an NOS score ≥7 and were deemed to have relatively high quality (see Fig. 2).

### 3.2. Incidence of UIAS

Heterogeneity was not observed among these studies ($p = 0.41$; $I^2 = 0\%$), so a fixed model was used for analysis. The five studies included 211 patients with internal double-J stents and 201 patients with external ureteral catheters. However, in the study by Echo et al. [7], the incidence of UIAS was calculated by the number of ureteroileal anastomoses, not patients. Typically, one individual has two ureters; thus, 'participants' in the study should be recorded as double the number of patients. In fact, UIAS occurred in 4/77 and 13/71 of the internal and external groups, respectively, and we supposed that there might be a patient with a solitary kidney in each group.

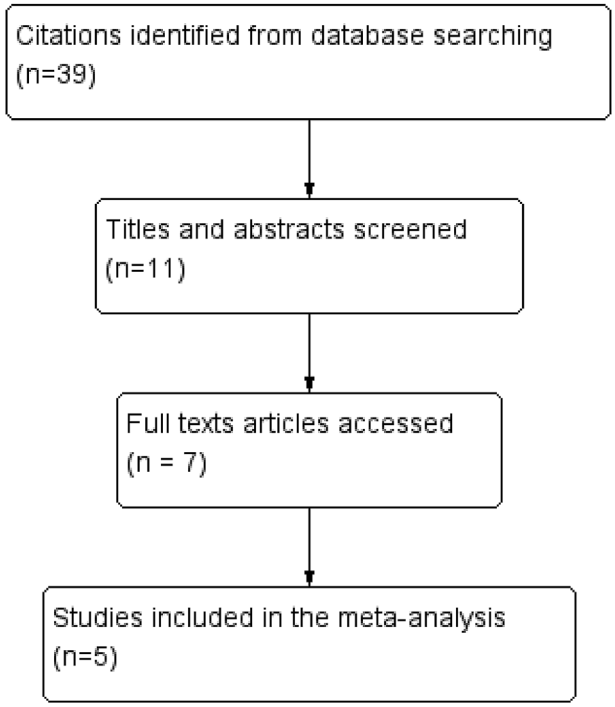


**Fig. 1.** Flow diagram for study selection.

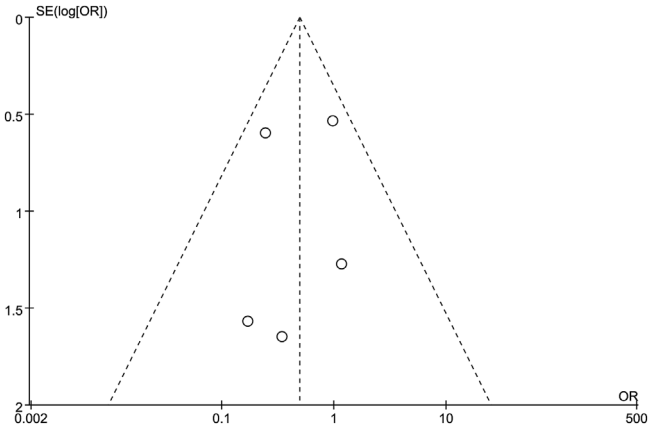


**Fig. 2.** Funnel plot of the meta-analysis.

The meta-analysis demonstrated a statistically significant difference in favor of an internal double-J stent (OR, 0.49; 95% CI, 0.25–0.97; $p = 0.04$) (Fig. 3).

### 3.3. Secondary outcomes

We attempted to conduct a meta-analysis for secondary outcomes but only succeeded with operation time based on two available studies (Fig. 4). There was no significant difference in the operation time between the internal stent and external catheter groups. Unfortunately, insufficient or different types of data (e.g., for length of stay, some studies presented it as the mean ± standard derivation, while others

**Table 1**
Characteristics of studies included in the meta-analysis.

| Resource | Country | Study design | Participants | | | NOS |
|---|---|---|---|---|---|---|
| | | | Internal stent | External catheter | Total | |
| Echo, 2009 | France | Case-control | 77 | 71 | 148 | 7 |
| Mahmoud, 2016 | Egypt | Prospective, non-RCT | 36 | 33 | 69 | 7 |
| Osman, 2016 | Egypt | RCT | 45 | 48 | 93 | 8 |
| Salvatore, 2001 | Italy | Case-control | 78 | 60 | 138 | 7 |
| Varkarakis, 2005 | Greece | Case-control | 13 | 30 | 43 | 7 |

RCT, randomized controlled trial; NOS, Newcastle–Ottawa Scale.

calculated it as the median with a quartile) detected in the studies failed in the performance of the meta-analysis for other outcomes. Thus, we extracted the data and put them in Table 2 to make a comparison of such outcomes between the internal double-J stent and the external ureteral catheter groups.

All of the five studies compared the length of stay between the two groups. It was obvious that patients with a double-J stent had a shorter hospitalization than those with an external ureteral catheter according to these studies, except the one by Echo et al. [7], in which the mean hospital stay was 16 days and 17 days in the internal and external groups, respectively. However, this may not impede the fact that internal double-J stents were likely to shorten the hospital stay for patients undergoing procedures with orthotopic neobladders.

The time to remove the internal double-J stent or external ureteral catheter was also detected in the five studies. Apparently, in most cases, the external ureteral catheter was removed within 15 days after surgery, while the double-J stent was removed at least 2 weeks and, at the longest, 6 weeks postoperatively. Two studies concluded that the external ureteral catheter group had a significantly earlier removal time than the internal double-J stent group. The other three studies did not illustrate a significant difference even when we attempted to calculate this factor on the basis of their data.

Complication outcomes are also presented in Table 2. Three studies calculated early and late complications, while two only compared the total complications. According to the data, the complication rates in the two groups seemed comparable.

## 4. Discussion

UIAS, also known as ureteroenteric stricture (UES), occurs in 0%–19% of patients after urinary diversion within 1–2 years [3–13], while it has been reported to be below 10% in most studies [3–6,8–11]. For patients undergoing orthotopic neobladder substitution, the incidence of UIAS is 0%–6.2% [3–9]. Ureteroenteric ischemia due to the long separation of the distal end of the ureter and poor suturing techniques leads to fibrous scar hyperplasia and results in UIAS [14]. The median time to the diagnosis of UIAS after surgery is 7–18 months for all types of urinary diversion [8]. For patients undergoing procedures for an orthotopic neobladder, four of the five included studies had a relatively long follow-up of more than 20 months [3–5,7]. Salcatore et al. [3] found that those suffering from UIAS were diagnosed within 18 months after surgery, and in the study of Eoch et al. [7], the median time to the diagnosis of UIAS was 8 months and 7.5 months in the ureteral catheter and double-J stent groups, respectively.

UIAS may result in kidney atrophy, even unilateral nephroureterectomy [11]. In addition to patients' comorbidities (ureteral cancer, hydronephrosis, etc.), surgeons' experiences and different approaches (open, laparoscopic and robot-assisted) as well as improvements in the techniques used for these procedures also play a role in lowering the UIAS rate. Based on the present meta-analysis, the placement of a double-J stent instead of an external ureteral catheter may reduce the incidence of UIAS, which is consistent with the trend of these included studies. In addition, an RCT demonstrated that urine leakage and upper urinary tract dilatation occurred less frequently in the group with perioperative double-J stent placement than in the group without stent placement in patients undergoing cystectomy and urinary diversion [13]. However, the ileal conduit and orthotopic neobladder, both of which are methods of urinary diversion, were involved in the study [13]. Because the different vesical pressure of a pouch might have an effect on the formation of UIAS, this study was not included in our meta-analysis. The reason that the internal double-J stent resulted in a lower UIAS rate than the external ureteral catheter is not clear. We deduced that double-J stents might result in low instances of injury and that patients with double-J stents are not likely to suffer from urinary infections after surgery.

There are also other strategies for reducing the incidence of UIAS. Talat et al. [15] found a new surgical technique, called the Anatolian neobladder, with a similar oncologic and safety outcome as the use of the standard Studer neobladder, as it resulted in less uretero-neobladder stenosis than the Studer neobladder (2.7% vs. 6.2%). Another method that compared the use of internal ureteric stents with that of urethral catheters was proven to be feasible and resulted in 2 out of 21 patients suffering from UIAS, but this study included a single arm and lacked a control group [16]. In addition, whether different methods of ureteroileal anastomosis, especially that of Bricker and Wallace, have an effect on the incidence of UIAS remains controversial. Kouba et al. [17] reported that Wallace anastomosis yielded a significantly lower incidence of UIAS than the Bricker method (0% vs. 3.7%). One study showed that 3/86 and 2/46 patients developed UIAS in the Wallace and Bricker groups, respectively, but the difference was not statistically

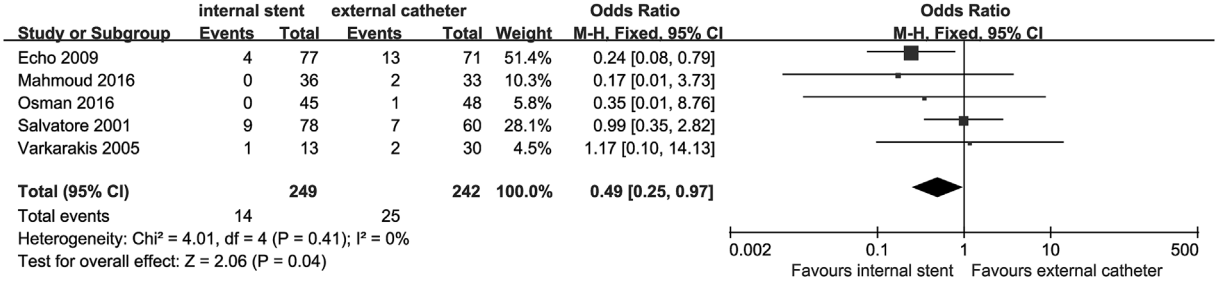


**Fig. 3.** Forest plot of the meta-analysis of internal double-J stent versus external ureteral catheter on ureteroileal anastomosis stricture.

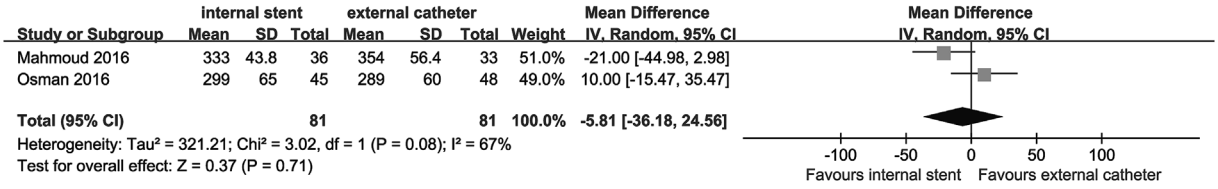


**Fig. 4.** Forest plot of the meta-analysis of internal double-J stent versus external ureteral catheter on operation time.

**Table 2**
Other outcomes reported by available studies.

| Resource | Length of hospital stay (d) | | | Time of removal internal stent or external catheter (d) | | | Complications in total (number of events) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Internal | External | *P* | Internal | External | *P* | Internal | External | *P* |
| Echo, 2009 | 16 | 17 | > 0.05 | 6 w | 12 | < 0.05 | 13 | 19 | > 0.05 |
| Mahmoud, 2016 | 6.8 ± 3.03 | 14.63 ± 3.74 | < 0.001 | 42.83 ± 5.06 | 12.63 ± 3.74 | < 0.05* | 6 | 8 | > 0.05 |
| Osman, 2016 | 14 (10–42) | 18 (14–32) | 0.001 | 2 w | 11 | NA | 4 | 7 | > 0.05 |
| Salvatore, 2001 | 15 (13–16) | 18 (16–19) | < 0.0001 | 2 m | 12–15 | NA | 19 | 29 | > 0.05* |
| Varkarakis, 2005 | 9.9 (7–20) | 15.2 (14–20) | < 0.005 | 21.5 (20–23) | 14.7 (14–19) | NA | 14 | 32 | > 0.05* |

d, day(s); w, week(s); m, month(s); NA, not applicable.
* Although it was not reported in original studies but we got a P value based on their data.

significant [18]. A meta-analysis that included four studies found no significant difference in the rate of UIAS after ileal conduit placement between the two groups [19]. Hong et al. [20] described a method that used a wider ureteroileal anastomotic stoma, called the Institute of Urology Peking University neobladder (IUPUB), which resulted in no cases of UIAS, with a median follow-up of 7.5 months. However, the long-term effects of this method need to be further verified. In addition, an RCT investigating the effect of a direct refluxing technique or an antireflux, serous-lined extramural tunnel (SLET) technique showed an incidence of UIAS of 1/102 and 5/102, respectively, based on self-control (right and left) [21]. Thus, the authors claimed that the anti-reflux technique should be cautiously used in procedures, especially for surgeons who do not have sufficient experience [21].

Whether there are any certain preoperative or perioperative factors that can predict UIAS after urinary diversion has been investigated. Shah et al. [8] found that none of the following factors of age, body mass index (BMI), Charlson comorbidity index, perioperative radiation or chemotherapy, or preoperative serum albumin could predict post-operative UIAS. However, in the study of Ahmed et al. [22], BMI, intracorporeal urinary diversion, the length of the right resected ureter, evaluated glomerular filtration rate (eGFR) 30 days after surgery, urinary tract infection (UTI) and leakage were all predictive factors of UIAS in patients undergoing robot-assisted radical cystectomy (RARC). On the other hand, male sex and a high BMI were associated with the failure of endoscopic management [22]. For open surgical intervention, preoperative percutaneous nephroureterostomy (PCNU) indicated a higher recurrence rate of UIAS than preoperative percutaneous nephrostomy (PCN) or without drainage [23].

The diagnosis of UIAS is based on symptoms and radiological examinations, but the majority of patients with UIAS are asymptomatic [4,8,10,24]. Once UIAS is diagnosed, the length of the stricture should be evaluated, and management should also be implemented in a timely manner. In total, there are two types of interventions, endoscopic treatment and open surgery, with respective indications. Endourological intervention should be given priority if the stricture segment is less than 1 cm, while open surgery is preferred in the following situations: a stricture segment longer than 1 cm, failed endourological intervention, UIAS recurrence, or complete obstruction of the stricture [25,26]. As two common types of endourological management, dilation as well as incision and stenting, also known as endoureterotomy, have similar successful rates compared with dilation and stenting only (52.4% vs. 50%) [10]. Open surgical intervention, especially ureteral reimplantation, has been proven to be sufficiently effective and safe for postcystectomy UIAS [10,23,27]. According to the findings of Nassar et al. [10], the long-term success rates were 51.3% and 82.7% in the endoureteral intervention and open surgery groups, respectively, regardless of the different types of urinary diversion used. In addition, open surgery resulted in a higher success rate in patients with neobladder substitution than in those with an ileal conduit [10]. However, a study by Helfand et al. [27] did not show a long-term renal functional improvement in patients undergoing reimplantation compared with those receiving nonoperative management, even though it was associated with better overall survival.

There were some limitations in this systematic review. First, only one RCT was enrolled in the meta-analysis, although the heterogeneity among the included studies was relatively satisfactory. In fact, patients in four studies received open radical cystectomy, while Mahmoud et al. [5] drew the conclusion based on laparoscopic cystectomy. In addition, detailed data were regarded as equally critical because either incomplete or inaccurate data in some studies (e.g., lack of standard deviation for continuous variants) have impeded more meta-analyses of other outcomes, such as the length of stay and complication rate. Regardless, the primary outcome of the present meta-analysis was determined via the conclusion that internal double-J stents may reduce the incidence of UIAS. More RCTs are needed for providing higher-level evidence of prophylactic measurements and interventions to reduce the incidence of UIAS in patients undergoing procedures with an orthotopic neobladder in the future.

## 5. Conclusions

Internal double-J stent placement was associated with a lower incidence of UIAS than external ureteral catheter placement in patients undergoing procedures with orthotopic neobladders. In addition, a trend of a shorter hospital stay was also detected, thus, internal double-J stent placement may be favored in the view of the ERAS.

## Ethical approval

Ethical approval or patient consent was not required since the present study was a review of previous published literatures.

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## Author contribution

Yubo Yang and Yunjin Bai: Literature search, full-texts screened, data analysis.

Xiaoming Wang and Ping Han: Help with the data extraction.

Yubo Yang, Yunjin Bai and Yin Tang: Draft the manuscript.

Xin Wei: Study design.

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Xin Wei.

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## Declaration of competing interest

None.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijsu.2019.10.023.

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